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Yanagimoto et al.

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(54) **FILM CARTRIDGE SORTING DEVICE FOR USE WITH PHOTOGRAPHIC FILM PROCESSOR**

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(22) Filed: **Nov. 16, 1998**

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(52) **U.S. Cl.** **209/682**; 209/680; 209/675; 209/707; 209/911; 209/924; 209/920; 209/311; 209/315; 209/317
(58) **Field of Search** 209/680, 682, 209/675, 707, 911, 924, 920, 311, 315, 317, 80

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(57) **ABSTRACT**

In a film processor, filmstrips are contained in their specific cartridge shells with their film leaders attached to a leader plate, and are fed into processing baths with the leader plate in the lead, while being pulled out from the cartridge shells. After the filmstrips are separated from the cartridge shells, the cartridge shells drop on a chute and slide down on the chute. Smaller cartridge shells sift through a sifting slit formed through the chute along the sliding direction, while larger cartridge shells slide down to a lower end of the chute. A lateral guide plate extends under the sifting slit, to guide smaller cartridge shells having sifted through the sifting slit in the lateral direction of the sifting chute toward a cartridge recovery box. Larger cartridge shells drop from the lower end of the chute down to a second cartridge recovery box.

15 Claims, 10 Drawing Sheets

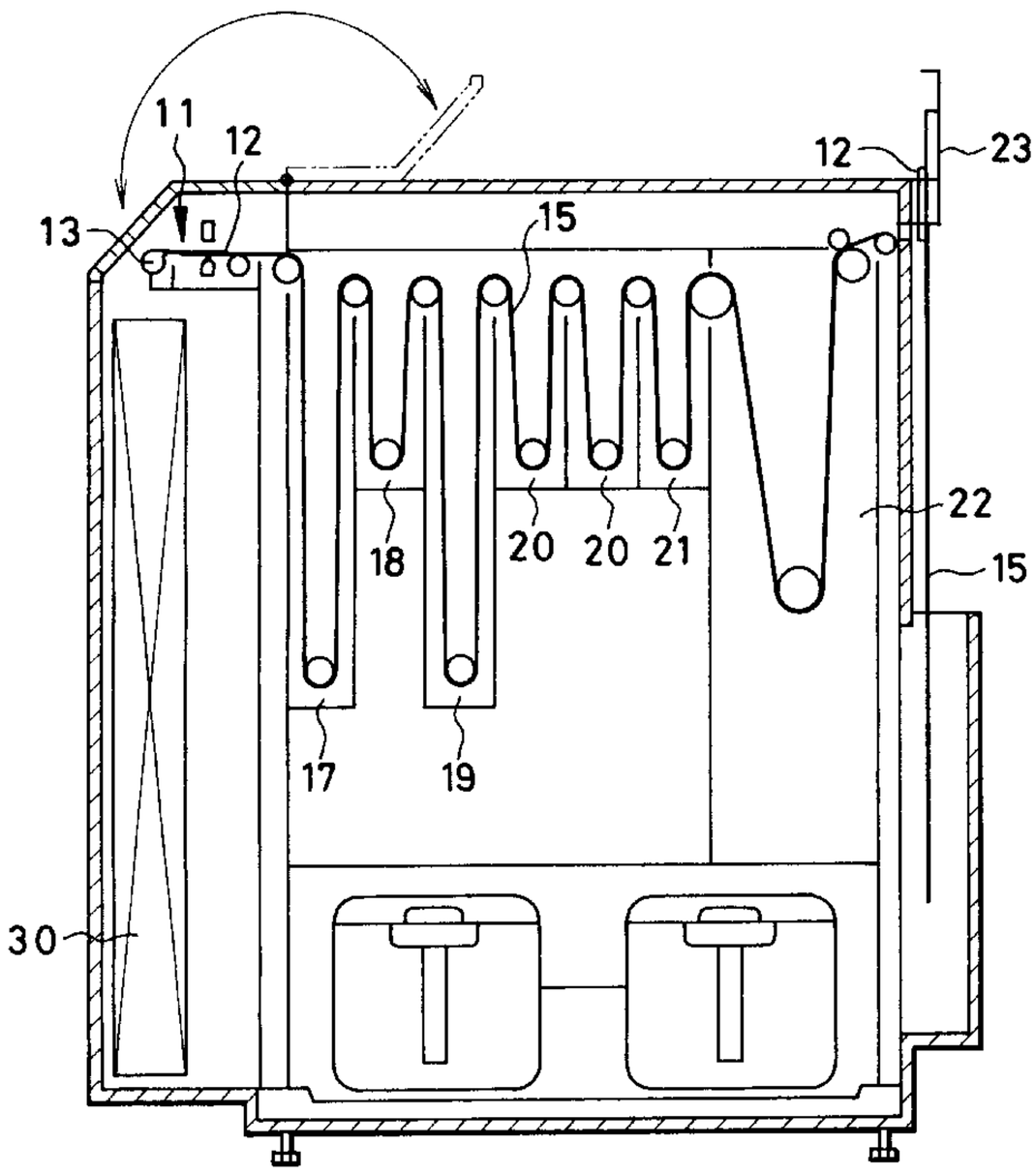

FIG. 1

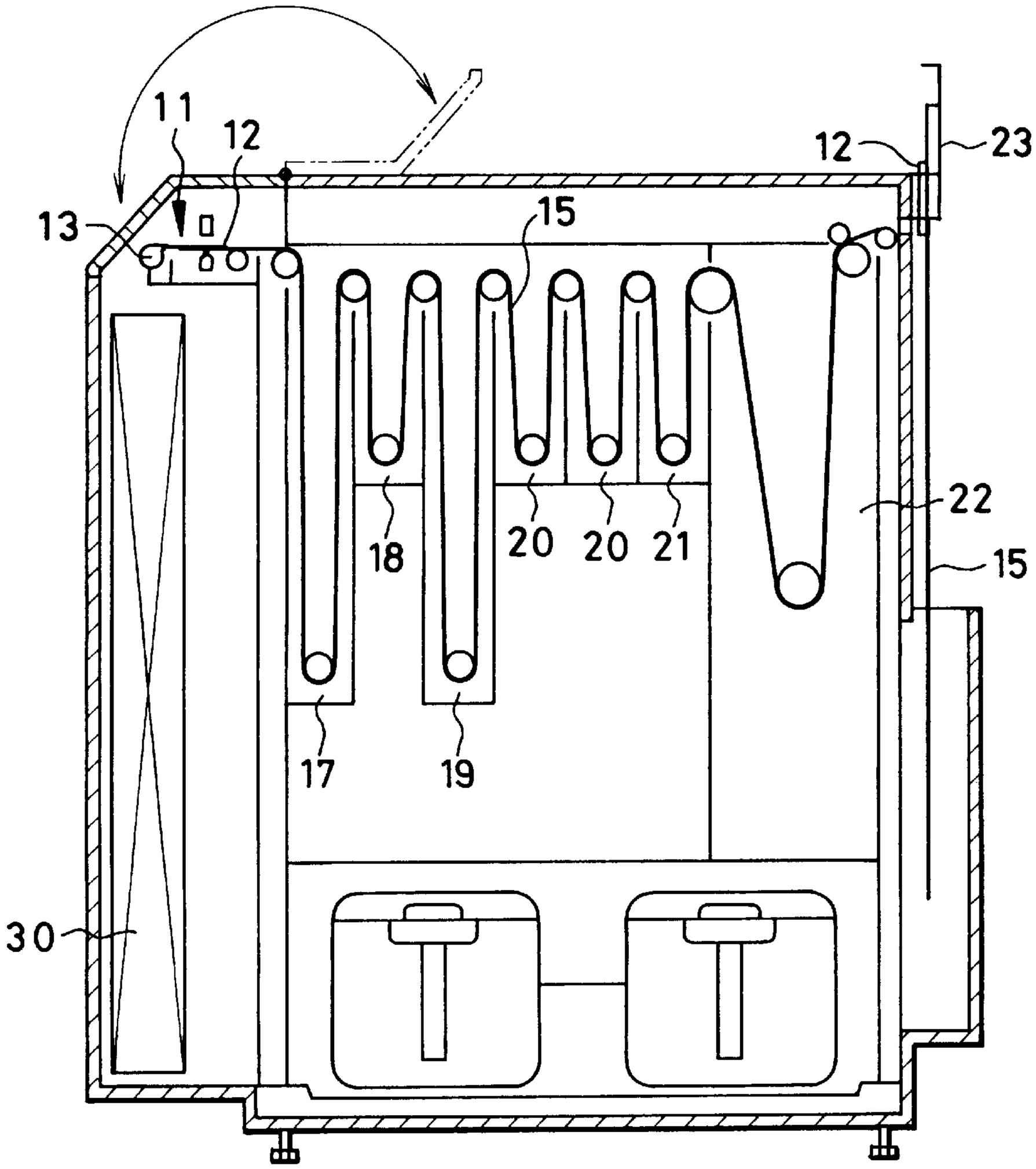

FIG. 2A

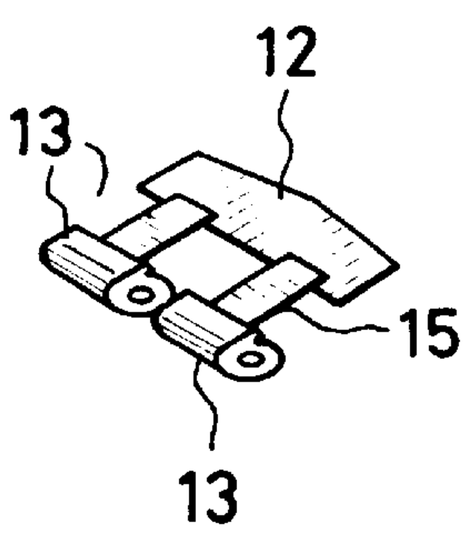

FIG. 2B

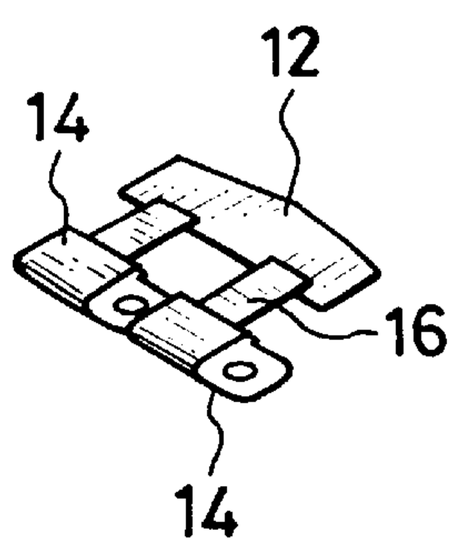

FIG. 3

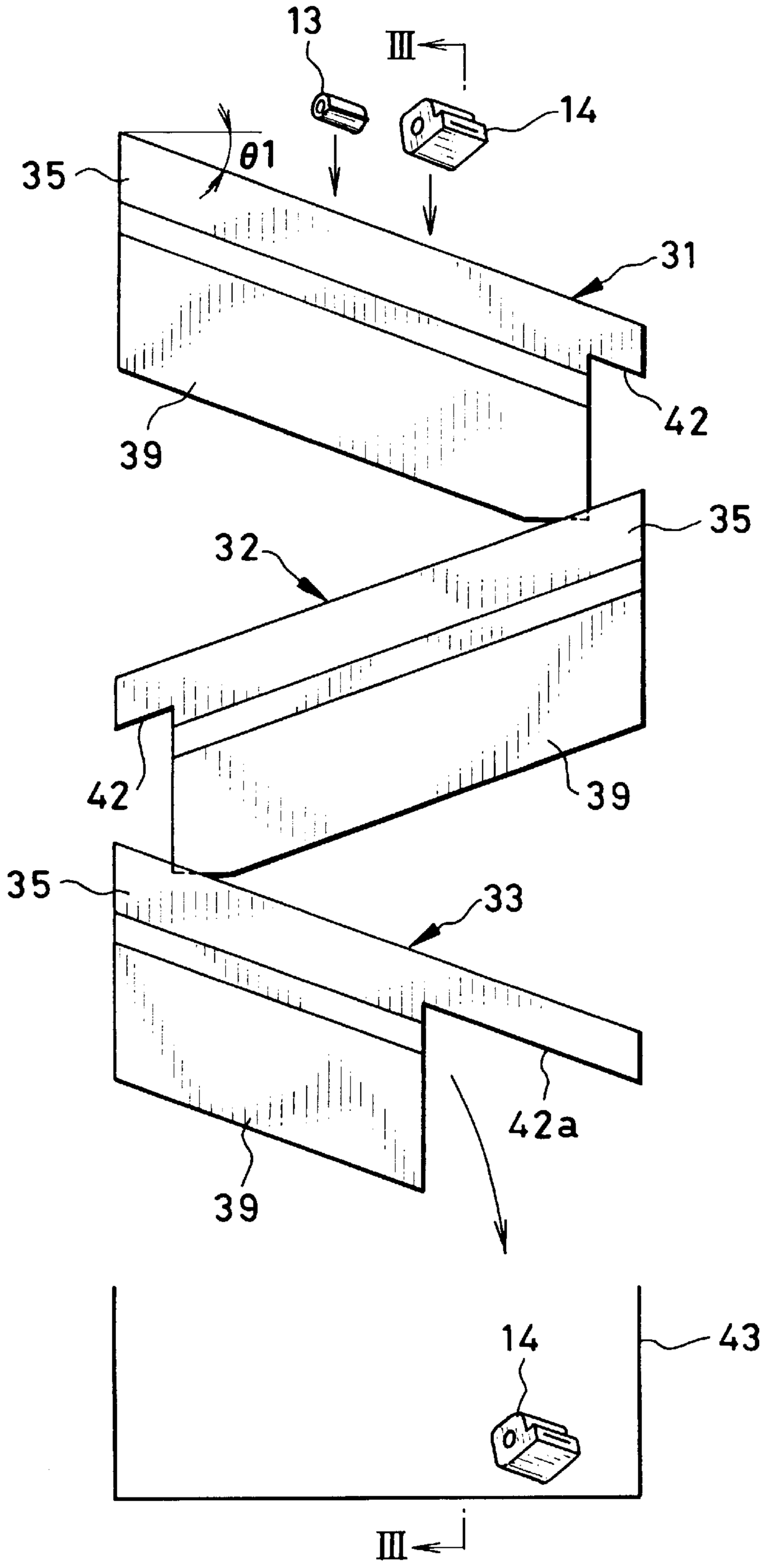

FIG. 4

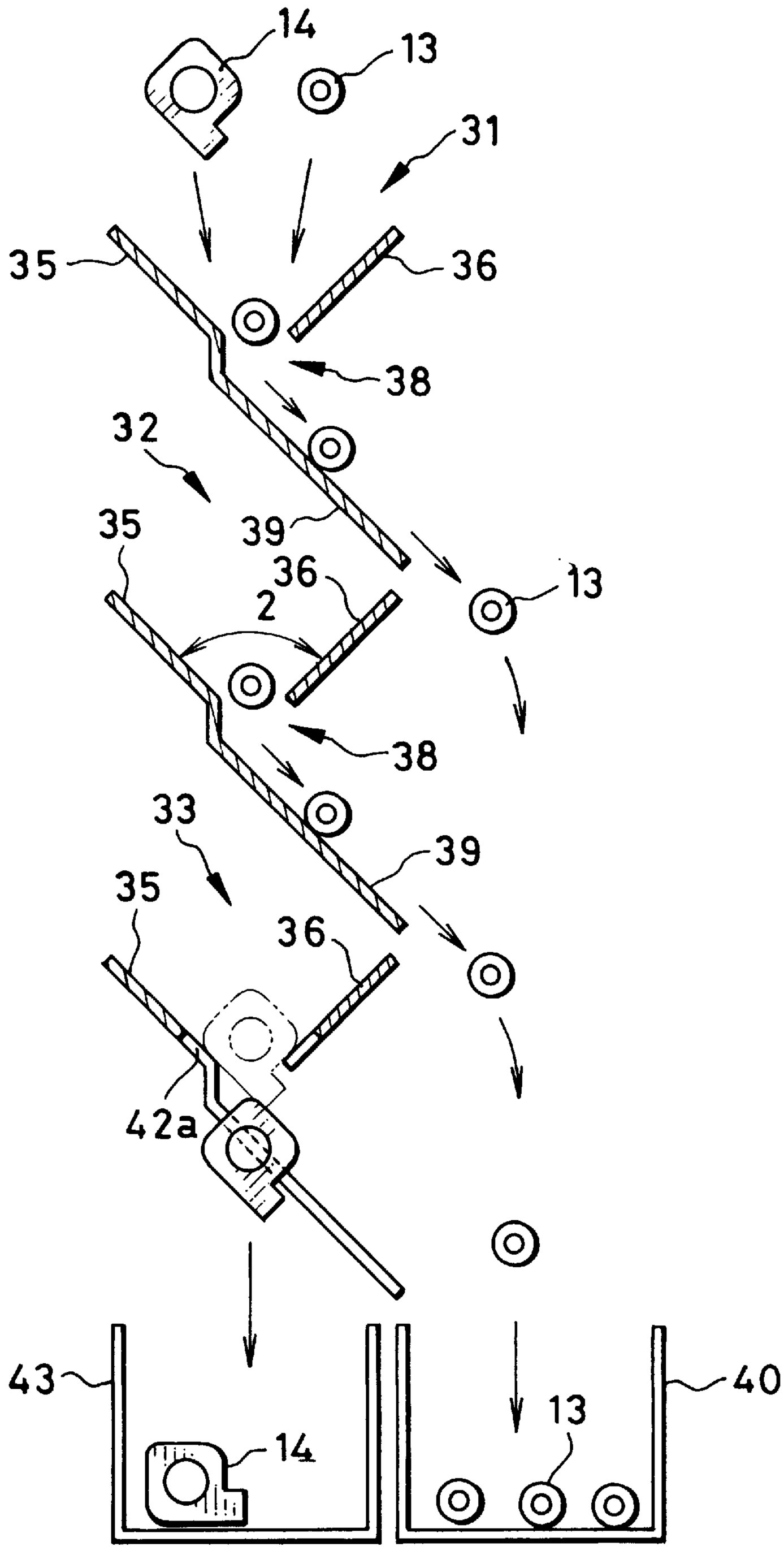

FIG. 5

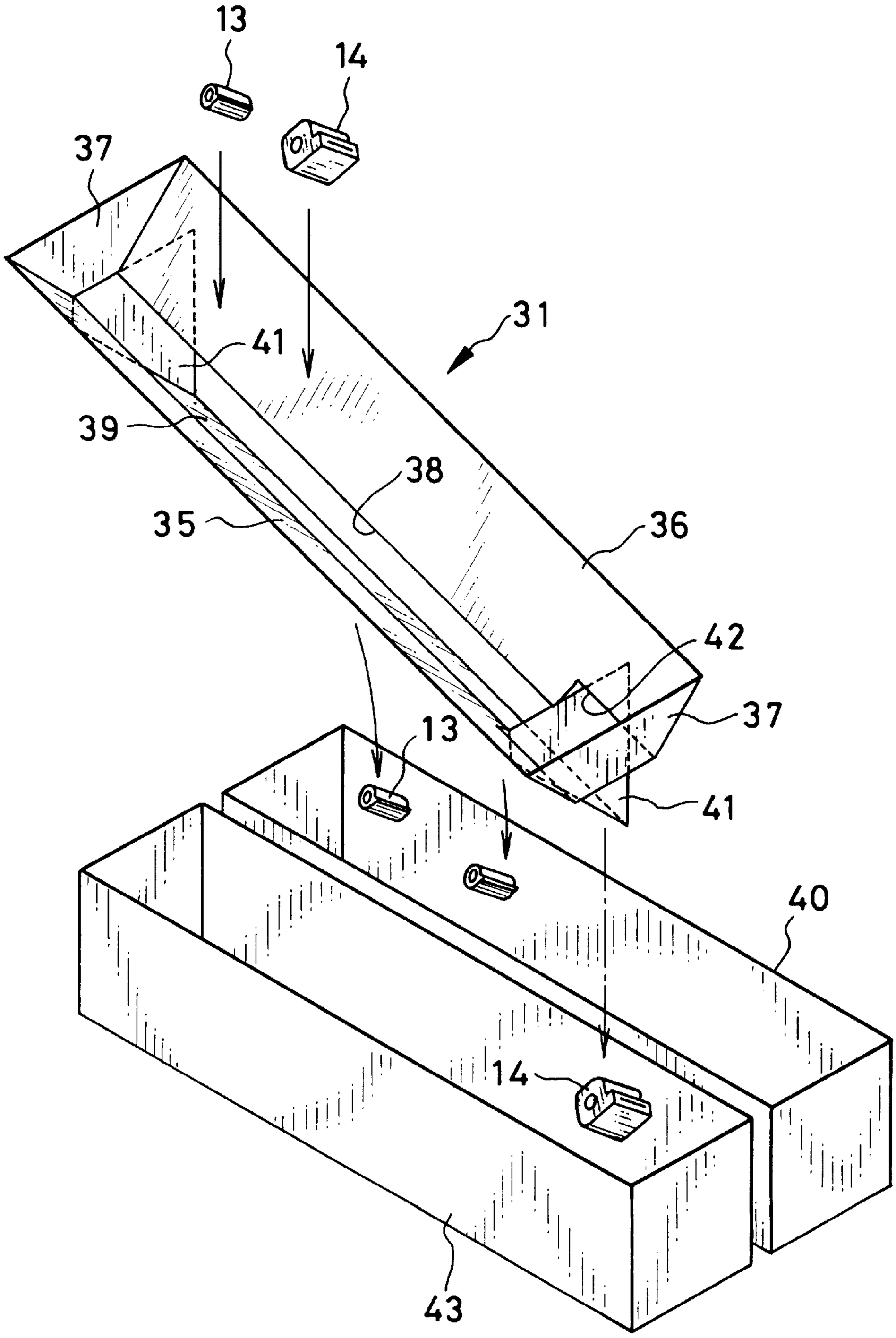

FIG. 6

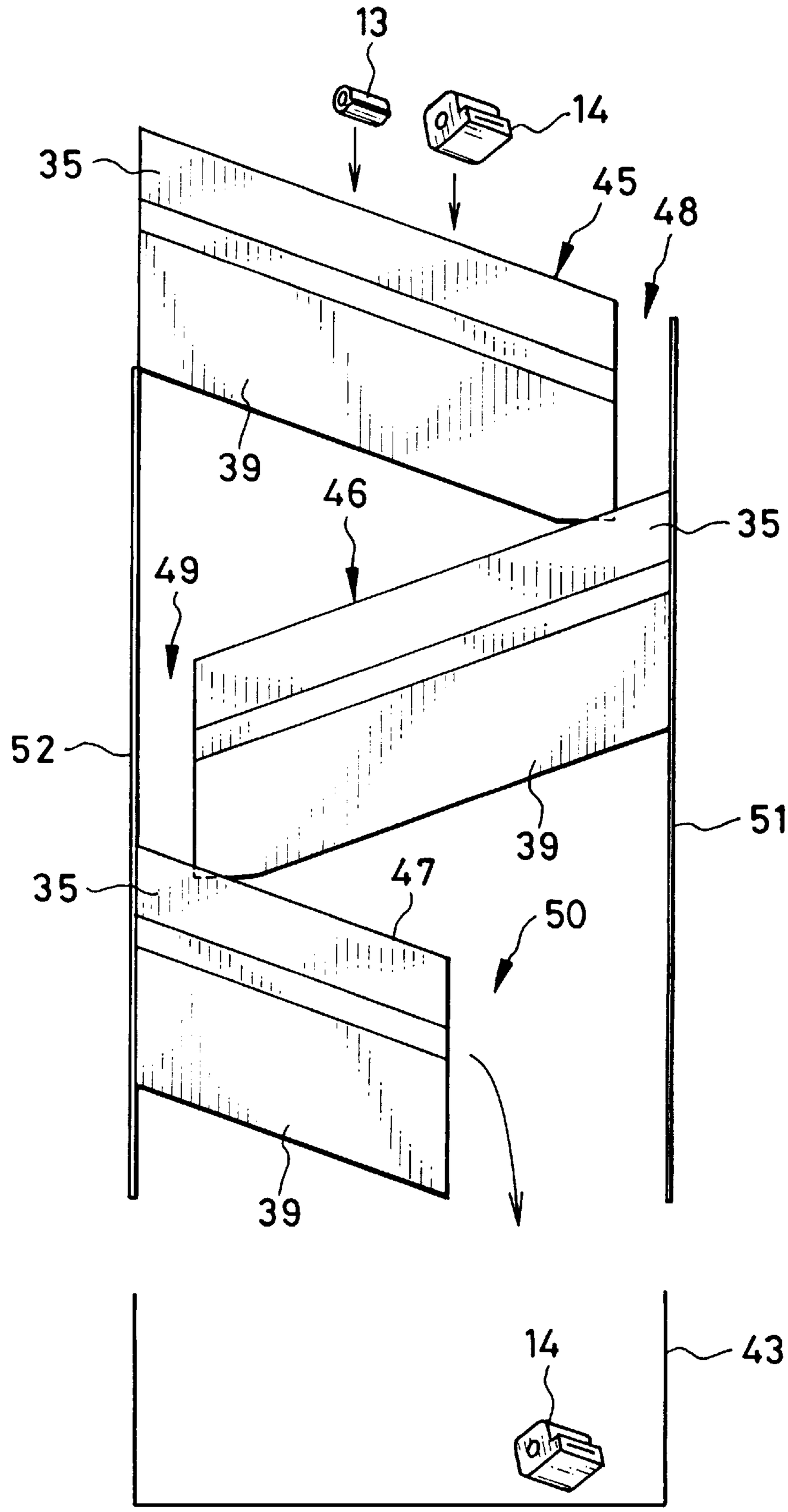

FIG. 7

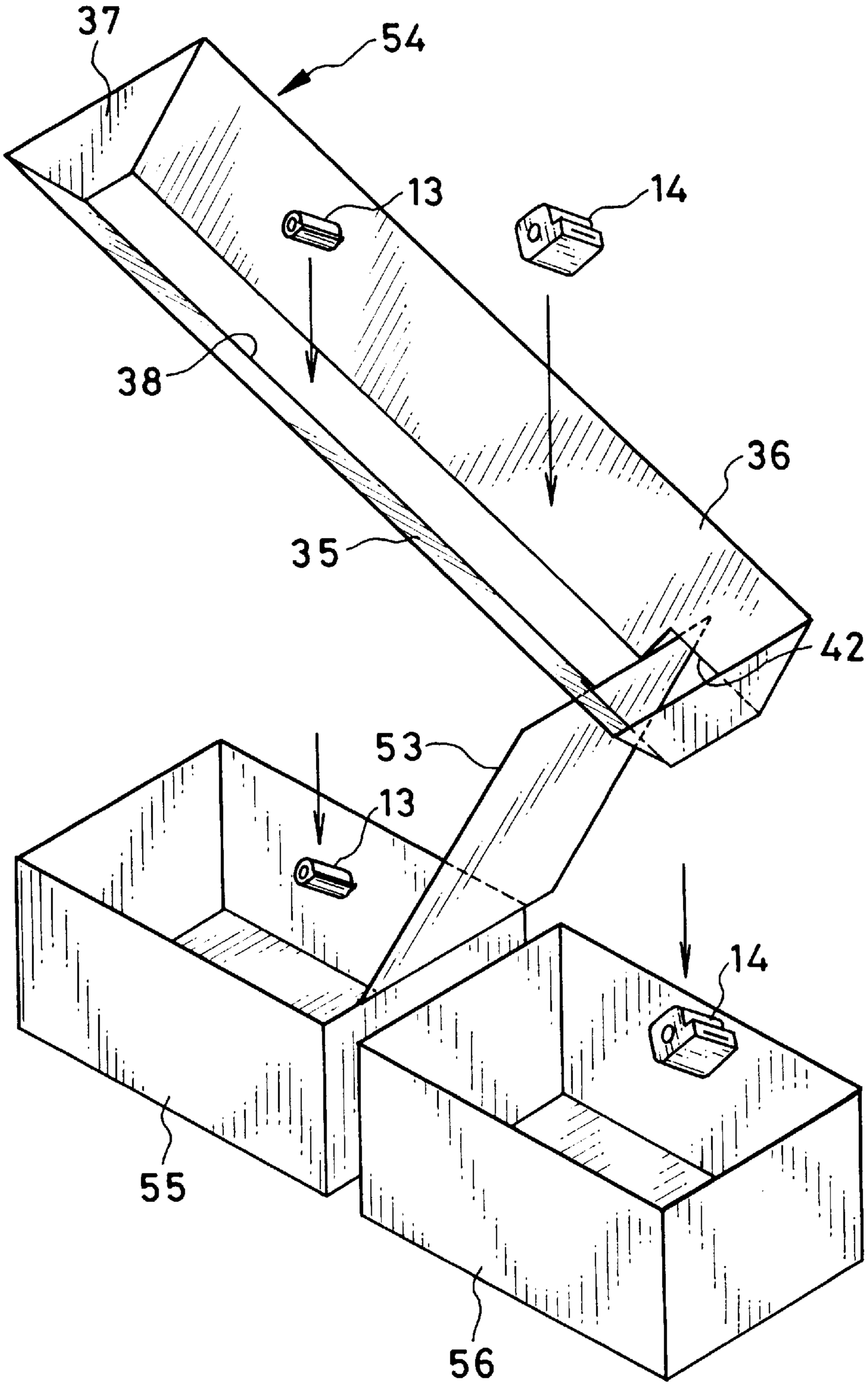

FIG. 8

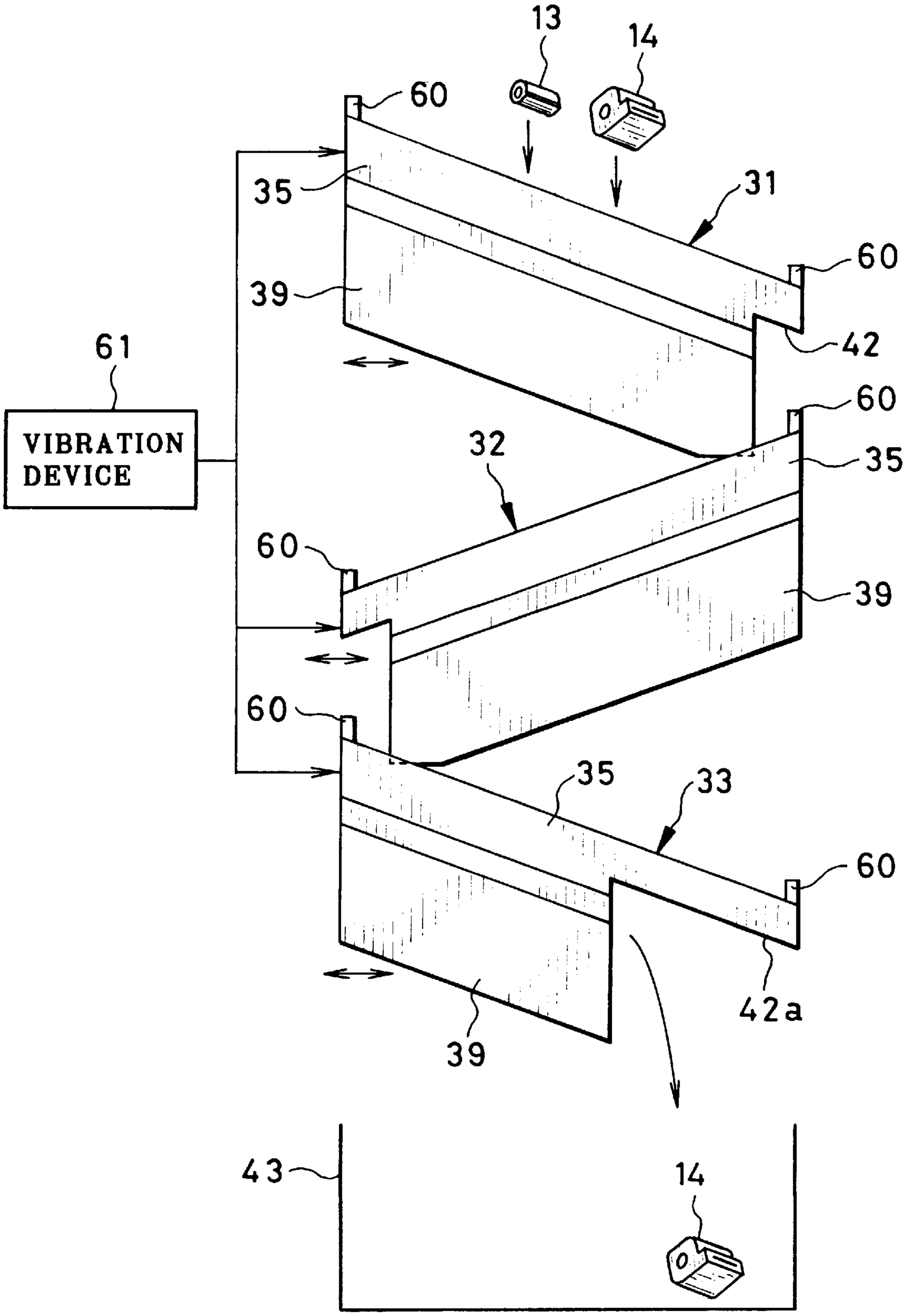
13
14
60
35
31
39
60
42
61
VIBRATION DEVICE
60
32
35
60
39
60
35
33
60
39
42a
43
14

FIG. 9

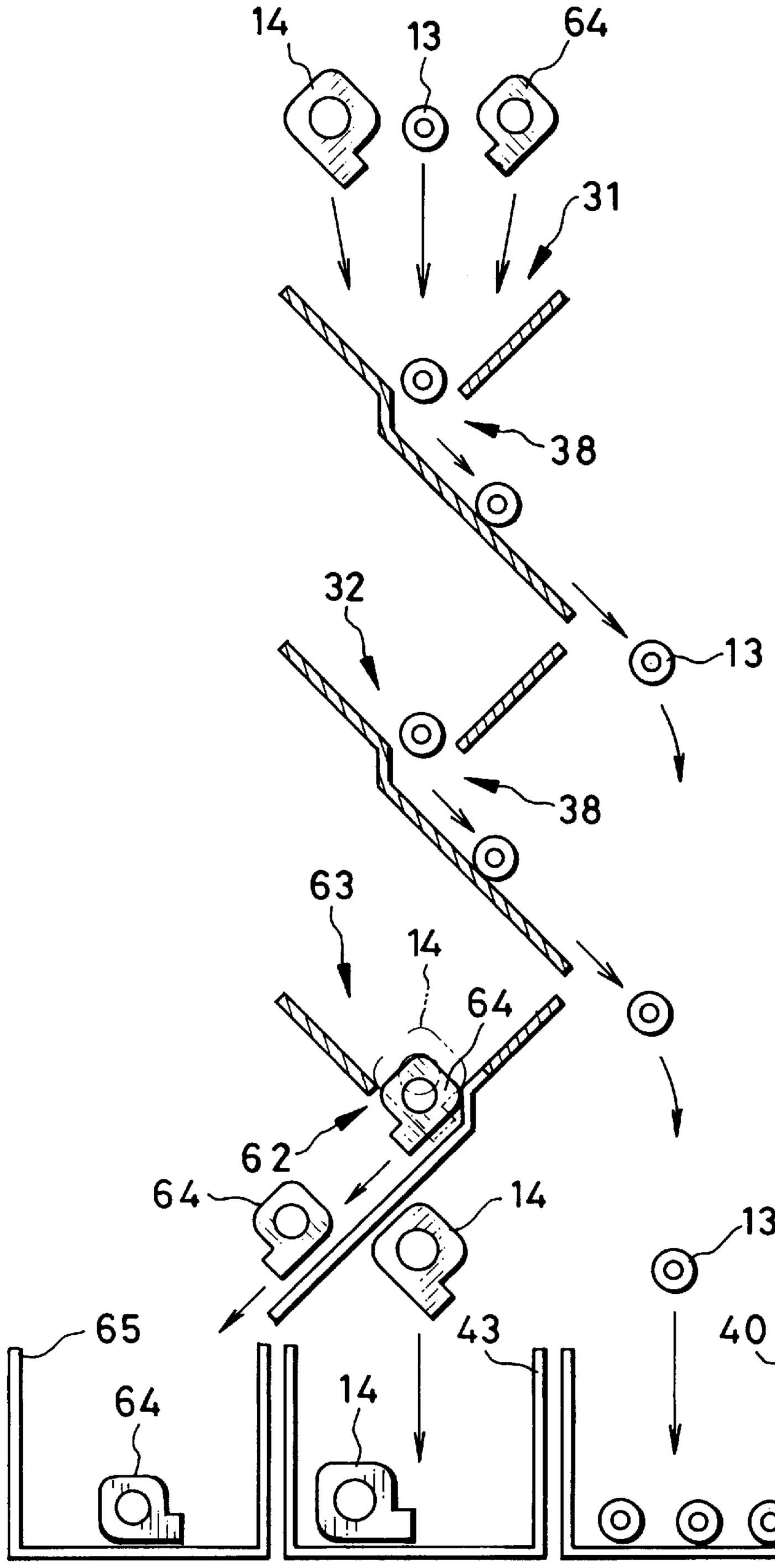

FIG. 10

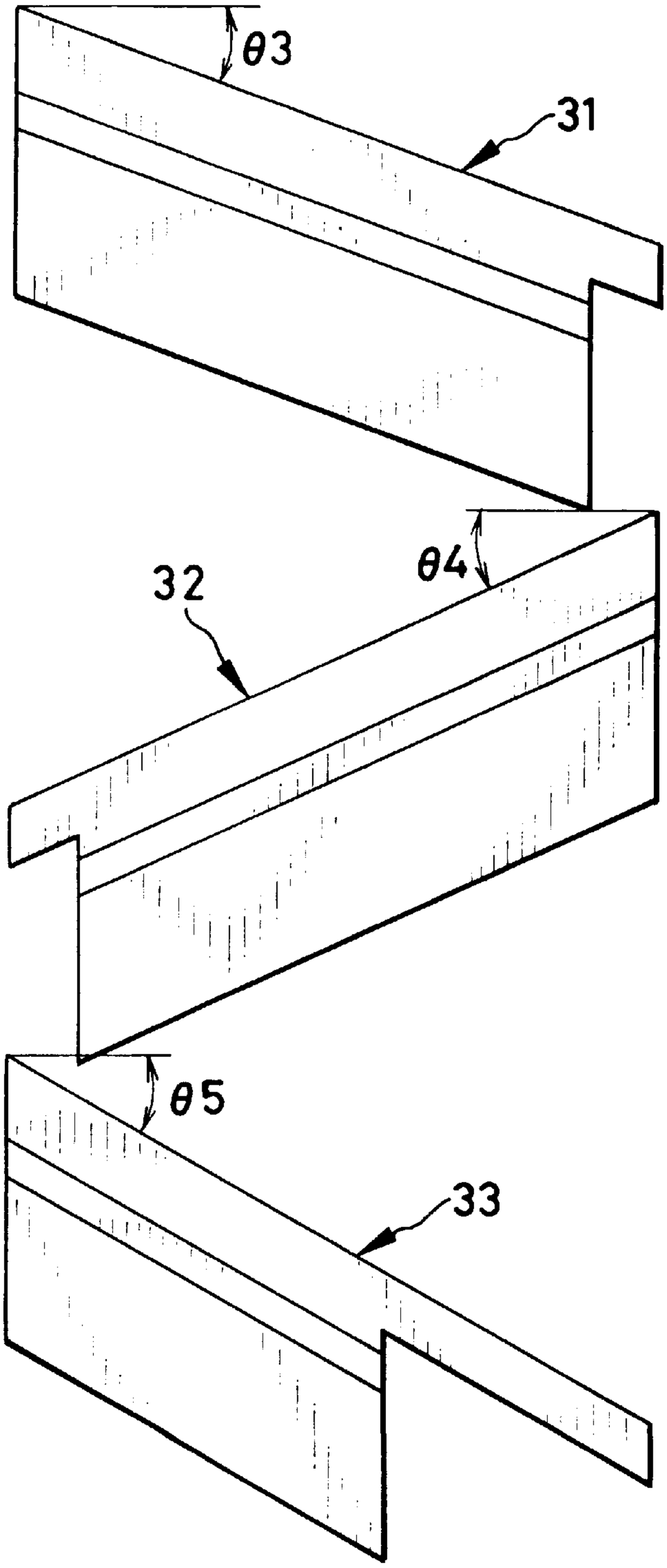

FIG. 11

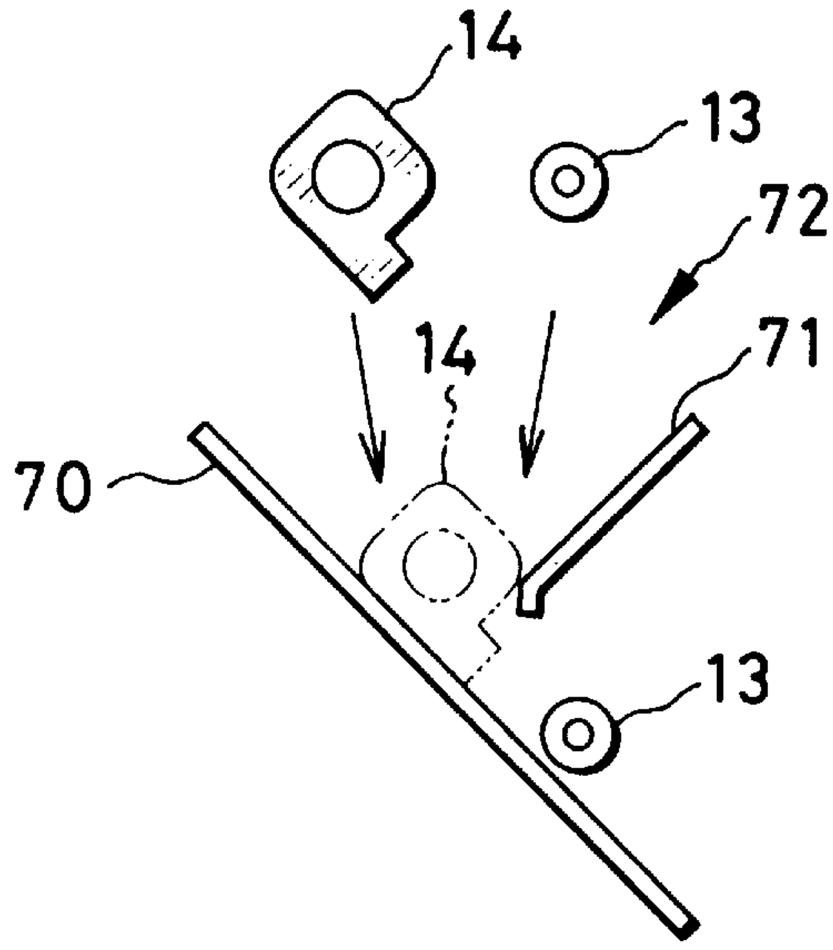

FIG. 12

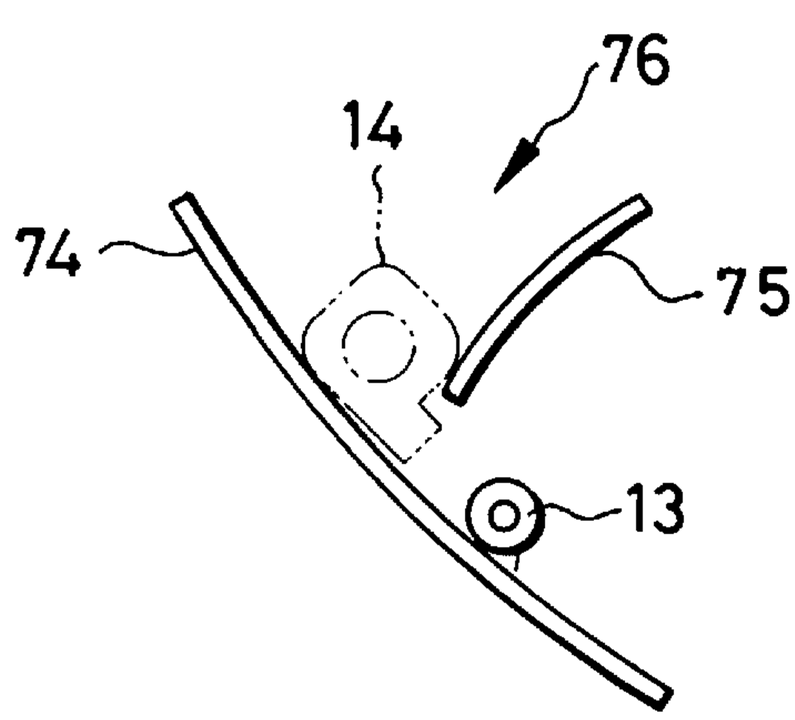

FIG. 13

FILM CARTRIDGE SORTING DEVICE FOR USE WITH PHOTOGRAPHIC FILM PROCESSOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a film cartridge sorting device for sorting film cartridges, especially those film cartridges which are to be discharged from a photographic film processor. The present invention also relates to a photographic film processor having the film cartridge sorting device incorporated thereinto.

2. Background Arts

There are various types of photo film cartridges, including ISO135 type, ISO110 type, ISO120 type and IX240 type. Cartridge shells as well as photo filmstrips are different in size and format between these types.

For development in a small scale automatic photographic film processor, hereinafter referred to as a mini-lab film processor, a film leader of a photo filmstrip is secured to a leader plate. Thereafter, the filmstrip is guided with the leader plate in the lead through several processing baths, such as a color developing bath, a bleaching bath, a bleach-fix bath, a super rinsing bath, and a stabilizing bath, as well as a drier section.

As for the ISO135 type photo film cartridge, the film leader is pulled out from its cartridge shell, and is attached to the leader plate. Thereafter, the cartridge shell is placed on a cartridge holder of the mini-lab film processor, while the filmstrip with its leader attached to the leader plate is further pulled out from the cartridge shell and is fed into the processing baths. When the filmstrip is fully pulled out from the cartridge shell, the filmstrip is cut at the trailing end off the cartridge shell. Then, the empty cartridge shell is dropped from the cartridge holder down to a cartridge recovery box.

As for other types of photo film cartridges, on the other hand, the individual photo filmstrip is pulled out from its original cartridge shell and then rewound into an intermediate cartridge shell that is specific to each film type. That is, the intermediate cartridge shells have different sizes from that of the ISO135 type cartridge shell, as well as from each other according to the film type. After the filmstrip is rewound into the intermediate cartridge shell, an end of the filmstrip that remains outside the shell is attached to the leader plate, and is placed in the mini-lab film processor in the same way as the ISO135 type photo film cartridge. An inner end of the filmstrip is not securely fastened in the intermediate cartridge shell, so that the filmstrip finally slips off the intermediate cartridge shell as the filmstrip is fed into the processing baths. When the entire length of the filmstrip is fed out of the intermediate cartridge shell, the intermediate cartridge shell drops off the cartridge holder down to the same cartridge recovery box as used for receiving the cartridge shell of the ISO135 type.

Among from the cartridge shells collected in the cartridge recovery box, the ISO 135 type cartridge shells are sorted out as wastes. The intermediate cartridge shells are also sorted according the film type, and are reused over again for containing filmstrips to develop.

Conventionally, sorting of the cartridge shells collected in the cartridge recovery box has been made by hand. This is labor intensive and inefficient.

An object of the present invention is to provide a film cartridge sorting device that can automatically sort the film cartridges according to the size of their cartridge shells.

Another object of the present invention is to provide a film cartridge sorting device that is simple in construction, and works without the need for electricity, and thus save the electric power.

SUMMARY OF THE INVENTION

The present invention is comprised of a chute to which the film cartridges to sort are fed; and a sifting slit formed through a bottom side of said chute along the sliding direction of the film cartridges, said sifting slit letting smaller film cartridges than a predetermined size fall therethrough, while larger film cartridges than the predetermined size slide down to a lower end of said chute.

According to a preferred embodiment, the chute is constituted of a pair of guide plates elongated in the sliding direction, said guide plates forming a substantially V-shaped sliding surface, and said guide plates being spaced laterally from each other to form said sifting slit.

According to another preferred embodiment, the cartridge sorting device further comprising a lateral guide plate extending under said sifting slit, for guiding said smaller cartridge shells having sifted through said sifting slit in the lateral direction of said sifting chute. This configuration facilitates arranging a plurality of said chutes vertically from one another, such that the lower end of an upper one of said chutes is opposed to an upper end of a next one of said chutes to provide a zigzag sliding path.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the present invention will become apparent from the following detailed description of the preferred embodiments when read in connection with the accompanying drawings, which are given by way of illustration only and thus are not limitative of the present invention, wherein like reference numerals designate like or corresponding parts throughout the several views, and wherein:

FIG. **1** is an explanatory sectional view of a mini-lab film processor having a film cartridge sorting device incorporated thereinto;

FIG. **2**A is a perspective view of ISO135 type photo film cartridges with their film leaders attached to a leader plate;

FIG. **2**B is a perspective view of filmstrips contained in intermediate cartridge shells with their film leaders attached to a leader plate;

FIG. **3** is an explanatory side view of a film cartridge sorting device according to a first embodiment of the present invention;

FIG. **4** is a sectional view of the film cartridge sorting device, taken along a line III—III of FIG. **3**;

FIG. **5** is an explanatory perspective view of the film cartridge sorting device of FIG. **3**;

FIG. **6** is an explanatory side view of a film cartridge sorting device according to a second embodiment of the present invention;

FIG. **7** is an explanatory perspective view of a film cartridge sorting device according to a third embodiment of the present invention;

FIG. **8** is an explanatory side view of a film cartridge sorting device according to a fourth embodiment of the present invention;

FIG. **9** is a sectional view of a film cartridge sorting device according to a fifth embodiment of the present invention;

FIG. **10** is an explanatory side view of a film cartridge sorting device according to a sixth embodiment of the present invention;

FIG. **11** is a sectional view of a sifting chute of a film cartridge sorting device according to another embodiment of the present invention;

FIG. **12** is a sectional view of a sifting chute of a film cartridge sorting device according to a further embodiment of the present invention; and

FIG. **13** is a sectional view of a sifting chute of a film cartridge sorting device according to still another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In a mini-lab film processor shown in FIG. **1**, a film entry section **11** can hold more than one cartridge containing a filmstrip to develop. As for the ISO135 type photo film cartridges, filmstrips **15** are pulled out from their cartridge shells **13** and are attached to a leader plate **12**, as shown in FIG. **2**A. As for other types of photo film cartridges, e.g. IX240 type photo film cartridges, the filmstrips **16** are rewound into intermediate cartridge shells **14**. Thereafter, a film leader of the filmstrip **16** in the intermediate cartridge shell **14** is attached to the leader plate **12**, as shown in FIG. **2**B.

Then, the cartridge shells **13** or **14** are placed with the filmstrips **15** or **16** and the leader plate **12** in the film entry section **11**. The filmstrips **15** or **16** are further pulled out from the cartridge shells **13** or **14** to be fed into processing baths, including a color developing bath **17**, a bleaching bath **18**, a bleach-fix bath **19**, a super rinsing bath **20**, and a stabilizing bath **21**. Thereafter the filmstrips **15** or **16** are fed into a drier section **22**. The filmstrips **15** or **16** developed in this way are hung on a film hanger **23** with their leader plate **12** upside, and stored for a while in the mini-lab film processor. Thereafter, photo prints are made from the developed filmstrips **15** or **16**. After the printing, the filmstrip **15** of the ISO135 type is cut into shorter lengths and inserted into a film sheath. The film sheath containing the developed filmstrip is returned to the individual customer, mostly along with the subsequent photo prints. The filmstrip **16** of the IX240 type is wound back, after the printing, into the original cartridge shell, and is returned to the individual customer.

The empty cartridge shells **13** or **14** are dropped into a film cartridge sorting device **30** that is provided in the mini-lab film processor.

According to the first embodiment shown in FIG. **3**, the film cartridge sorting device **30** is constituted of three sifting chutes **31**, **32** and **33** which are arranged vertically from one another in this order from the top. The sifting chutes **31** to **33** are alternately inclined in the opposite directions, so the sliding directions on the sifting chutes **31** to **33** change alternately, providing a zigzag sliding path as a whole. In this embodiment, each of the sifting chutes **31** to **33** has a length of 300 mm, whereas the mini-lab processor has a width of about 400 mm, so the sifting chutes **31** to **33** can extend across the width of the mini-lab processor. The three sifting chutes **31** to **33** have the same inclination angle **Θ1**, e.g. 20 degrees, with respect to the horizontal. However, the length and the inclination angle of the sifting chutes **31** to **33** may be changed according to the conditions of the sifting chutes **31** to **33**, e.g. the frictional factor of their surfaces.

As shown in FIG. **4**, each of the sifting chutes **31** to **33** is constituted of a pair of guide plates **35** and **36** which are inclined in the opposite directions with respect to the vertical, so the guide plates **35** and **36** form a substantially V-shaped sliding surface. In this embodiment, the guide plates **35** and **36** meet at an angle **Θ2** of 90°, but the angle **Θ2** can be other than 90°. A sifting slit **38** is formed along the bottom of each of the sifting chutes **31** to **33** between the guide plates **35** and **36**. The sifting slits **38** have a width that allows only the ISO135 type cartridge shell **13** to sift therethrough, and does not let the intermediate cartridge shell **14** and other types of cartridge shells therethrough. In this embodiment, the width of the sifting slit **38** is 27.5 mm, since the diameter of the ISO135 type cartridge shell **13** is about 25 mm.

Accordingly, when a mixture of the ISO135 type cartridge shells **13** and the intermediate cartridge shells **14** drop from the film entry section **11** onto an upper portion of the sifting chute **31**, the ISO135 type cartridge shells **13** sift through the sifting slits **38** while sliding down the sifting chutes **31** to **33**, whereas the intermediate cartridge shells **14** slide down to the lower end of the lowest sifting chute **33**. As shown in FIG. **5**, stop plates **37** are provided at the upper and lower ends of the sifting chutes **31** to **33** to prevent the cartridge shells **13** and **14** from falling off the sifting chutes **31** to **33** at these ends. It is to be noted that the lower sifting chutes **32** and **33** are not illustrated in FIG. **5** for clarity sake.

To guide the ISO135 type cartridge shells **13** to one lateral sides of the sifting chutes **31** to **33**, a lateral guide plate **39** is provided under each sifting slit **38**. In this embodiment, the lateral guide plate **39** is formed integrally with the guide plates **35**. The ISO135 type cartridge shells **13** passing through the sifting slits **38** slide down the lateral guide plates **39** and drop down into a cartridge recovery box **40** for the ISO135 type cartridge shells **14**. As shown in FIG. **5**, stop plates **41** are provided at longitudinal ends of the lateral guide plates **39**, for preventing the ISO135 type cartridge shells **13** from falling off the lateral guide plate **39** down to the lower sifting chute **32** or **33**.

The sifting chutes **31** to **33** further have dropping openings **42** and **42***a* for the intermediate cartridge shells **14** at their lower ends in connection to the sifting slits **38**. The dropping openings **42** and **42***a* are wider than the sifting slits **38**, e.g. 40 mm wide, so the intermediate cartridge shells **14** can get through the dropping openings **42** and **42***a* and drop down to the lower sifting chute **32** or **33**, or to a second cartridge recovery box **43** that is provided for the intermediate cartridge shells **14**. In this embodiment the dropping openings **42** and **42***a* of the upper two sifting chutes **31** and **32** have a length of 70 mm, whereas the dropping opening **42***a* of the lowest sifting chute **33** has a length of about 140 mm. That is, the sifting slit **38** of the lowest chute **33** is shorter than those of the upper chute **31** and **32** because most of the ISO135 type cartridge shells **13** sift through the sifting slits **38** of the upper sifting chutes **31** and **32**.

The cartridge recovery boxes **40** and **43** are drawn out from the mini-lab film processor through a door that is not illustrated in the drawings. In this way, the ISO135 type cartridge shells **13** are automatically sorted out from the intermediate cartridge shells **14**. The ISO135 type cartridge shells **13** may be damaged by the shock that is given when they fall from the upper sifting chutes **31** and **32** down to the cartridge recovery box **40**. But it does not matter to the ISO135 type cartridge shells **13**, because the ISO135 type cartridge shells **13** are thrown away as industrial waste, or broken for recovering materials. On the contrary, since the intermediate cartridge shells **14** are discharged through the dropping opening **42***a* of the lowest sifting chute **33**, the shock given to the intermediate cartridge shells **14** is minimum. Therefore, the cartridge sorting device **30** of the present invention is preferable for the sake of reusing the intermediate cartridge shells **14** many times.

In the above embodiment, the sifting chutes **31** to **33** have the dropping openings **42** and **42***a* at their lower ends. It is possible to replace the sifting chutes **31** to **33** with sifting chutes **45**, **46** and **47** whose lower ends are shortened by the lengths of the dropping openings **42** and **42** respectively, as shown in FIG. **6**. In this embodiment, the intermediate cartridge shells **14** drops off the sifting chutes **45** to **47** through gaps **48**, **49** and **50** between their lower ends and stopping walls **51** or **52**. In FIG. **6** and in the following embodiment, like or corresponding parts are designated by the same reference numbers as used in the first embodiment, so that the following description relates only to those features essential to the respective embodiments.

The above embodiments use three sifting chutes **31** to **33** or **45** to **47**, but the number of the sifting chutes may be less than three or more than three. When using a single sifting chute, it is possible to omit the lateral guide plate **39** and provide a partitioning plate **53** instead, as shown in FIG. **7**. The partitioning plate **53** extends diagonally from the border between a sifting slit **38** and a dropping opening **42** down to a cartridge recovery box **55** for the ISO135 cartridge shells **13** that is placed under the sifting slit **38** of the sifting chute **54**. According to the third embodiment of FIG. **7**, a cartridge recovery box **56** for the intermediate cartridge shells **14** is placed under the dropping opening **42**. The sliding surfaces of the sifting chutes **31** to **33**, or **45** to **47**, or **54** are preferably overlaid with rubber sheets or the like, for buffering the shock of drop.

For more effective sifting, it is preferable to vibrate the sifting chutes **31** to **33**, or **45** to **47**, or **54**, as shown for example in FIG. **8**. In that case, the sifting chutes **31** to **33** are supported by elastic supporting members **60** or by slidable members, and are vibrated by a vibration device **61**. For example, the vibration device **61** is constituted of eccentric cams that are rotated by a motor, and vibrates the sifting chutes **31** to **33** in one or more than one of the longitudinal, lateral and vertical directions of the sifting chutes **31** to **33**. It is possible to vibrate the sifting chutes **31** to **33** in different directions from each other. For example, vibrating the highest sifting chute **31** in the longitudinal direction, the middle sifting chute **32** in the lateral direction, and the lowest sifting chute **33** in the vertical direction will improve the efficiency of sorting the cartridge shells **13** and **14**.

It is also possible to provide sifting slits of different widths in the individual sifting chutes so as to sort cartridge shells into more than two types or sizes. According to an embodiment shown in FIG. **9**, upper two sifting chutes **31** and **32** have sifting slits **38** of the same width for sifting the ISO135 type cartridge shells **13**, whereas a third sifting chute **63** in the lowest position has a sifting slit **62** that is wider than the sifting slit **38** but not wider enough for the intermediate cartridge shells **14** of the IX240 type to drop therethrough. According to this configuration, those cartridge shells **64** which are smaller than the intermediate cartridge shells **14** but larger than the ISO135 type cartridge shells **13**, e.g. intermediate cartridge shells **64** for the ISO110 type filmstrip, go through the sifting slit **62** and slide down to a third cartridge recovery box **65**. The intermediate cartridge shells **14** and the ISO135 type cartridge shells **13** are discriminated in the same way as the first embodiment shown in FIGS. **3** to **5**.

The film types are not limited to those mentioned in the above embodiments, but the cartridge sorting device **30** of the present invention can sort out cartridge shells of any types, if only their diameters or other dimensions are different, by designing sifting slits or dropping openings in correspondence with their dimensions. For instance, intermediate cartridge shells for the ISO120 type filmstrip have a larger diameter than those for the IX240 type, so sifting slits for the ISO120 type should be wider than sifting slit for the IX240 type. In any case, the lower sifting chute should have the wider sifting slit.

In FIG. **3**, the sifting chutes **31** to **33** have the same inclination angle **Θ1**. But the sifting chutes **31** to **33** may have different inclination angles **Θ3**, **Θ4** and **Θ5** from each other, as shown in FIG. **10**, wherein **Θ3<Θ4<Θ5**. It is preferable to make the lower sifting chute have the larger inclination angle. This is because the sliding speed of the cartridge shells decreases as the cartridge shells slide down along the sifting chutes of the same inclination angle. By making the lower sifting chute steeper, the cartridge shells slide down at the same or increasing sliding speed, so that the cartridge shells would not stagnate on the lower sifting chutes.

The shape of the sifting chute is not limited to the above embodiments. According to an embodiment shown in FIG. **11**, a pair of guide plates **70** and **71** having different widths constitute a sifting chute **72**. The wider guide plate **70** extends diagonally to an area under the narrower guide plate **71**, so that the wider guide plate **70** doubles as a lateral guide plate for ejecting the ISO135 type cartridge shells **13** or another type of smaller cartridge shells from the sifting chute **72**. Instead of the plane guide plates **70** and **71**, curved guide plates **74** and **75** or **77** and **78** may be used for constituting a sifting chute **76** or **79**, as shown in FIG. **12** or **13**.

The cartridge sorting device **30** of the present invention may be a separate apparatus that is attachable to a film processor or is installed independently. In that case, a mixture of different types of cartridge shells collected in a recovery box from the film processor are thrown into the cartridge sorting device. Then the cartridge shells are automatically sorted through the cartridge sorting device.

As described so far, according to the present invention, cartridge shells of different types and sizes are sifted through the sifting slit while sliding along the sifting chute. Therefore, the cartridge sorting device of the present invention is simple in construction, and economical and ecological as it needs no electricity nor driving power. By providing the lateral guide plate, the cartridge shells having sifted through the sifting slit are guided in the lateral direction of the sifting chute, so that the sifted cartridge shells automatically drop in the cartridge recovery box that is placed on one side of the sifting chute. This configuration also makes it possible to arrange a plurality of sifting chutes vertically from one another, and connecting them in a zigzag fashion. Thereby, the cartridge sorting device is made compact while the total length of the sifting chutes is sufficient for reliable sorting.

The present invention is not to be limited to the above embodiments, but on the contrary, various modifications will be possible without departing from the scope of appended claims.

What is claimed is:

1. A cartridge sorting device, comprising:

a film cartridge chute which receives only film cartridges and which sorts according to the size of their cartridge shells; and

a sifting slit formed through a bottom side of said film cartridge chute along the sliding direction of the film cartridges, said sifting slit letting smaller film cartridges than a predetermined size fall therethrough,

while larger film cartridges than the predetermined size slide down to a lower end of said film cartridge chute.

2. A cartridge sorting device according to claim **1**, wherein said chute comprises a pair of guide plates elongated in the sliding direction, said guide plates forming a substantially V-shaped sliding surface, said guide plates being spaced laterally from each other to form said sifting slit.

3. A cartridge sorting device according to claim **2**, wherein a first member for receiving said smaller film cartridges is placed under said sifting slit, and a second member for receiving said larger film cartridges is placed under the lower end of said chute.

4. A cartridge sorting device according to claim **2**, further comprising an opening formed through said chute at a lower end thereof, said opening being wider than said sifting slit so said larger film cartridges can drop therethrough.

5. A cartridge sorting device according to claim **2**, further comprising a lateral guide plate extending under said sifting slit, for guiding said smaller cartridge shells having sifted through said sifting slit in the lateral direction of said chute.

6. A cartridge sorting device according to claim **5**, wherein said lateral guide plate is formed integrally with one of said guide plates.

7. A cartridge sorting device according to claim **5**, wherein a plurality of said chutes are arranged vertically from one another, the lower end of an upper one of said chutes being opposed to an upper end of a next one of said chutes to provide a zigzag sliding path.

8. A cartridge sorting device according to claim **7**, wherein the sifting slit of a lower one of said chutes is wider than the sifting slit of the upper chutes, so as to sort the film cartridges into at least three sizes.

9. A cartridge sorting device according to claim **7**, wherein a lower chute is steeper than the upper chute.

10. A cartridge sorting device according to claim **1**, further comprising vibration means for vibrating said chute.

11. A cartridge sorting device according to claim **7**, further comprising vibration means for vibrating said chutes in different directions.

12. A film processor for photographically processing exposed filmstrips, wherein the filmstrips are contained in their specific cartridge shells with their film leaders attached to a leader plate, and are fed into processing baths with the leader plate in the lead, the filmstrips being pulled out from the cartridge shells, the film processor comprising:

a film cartridge chute which receives only the cartridge shells, after being separated from the filmstrips;

a sifting slit formed through a bottom side of said film cartridge chute along a sliding direction of the film cartridges, said sifting slit letting smaller cartridge shells than a predetermined size sift therethrough, while larger cartridge shells than the predetermined size slide down to a lower end of said film cartridge chute:

a first cartridge recovery box placed below said film cartridge chute so as to receive said smaller cartridge shells having sifted through said sifting slit; and

a second cartridge recovery box placed under the lower end of said film cartridge chute so as to receive said larger cartridge shells.

13. A film processor according to claim **12**, wherein said chute comprises of a pair of guide plates elongated in the sliding direction, said guide plates forming a substantially V-shaped sliding surface, said guide plates being spaced laterally from each other to form said sifting slit.

14. A film processor according to claim **13**, further comprising a lateral guide plate extending under said sifting slit, for guiding said smaller cartridge shells having sifted through said sifting slit in the lateral direction of said sifting chute toward said first cartridge recovery box.

15. A film processor according to claim **14**, wherein a plurality of said chutes are arranged vertically from one another, the lower end of an upper one of said chutes being opposed to an upper end of a next one of said chutes to provide a zigzag sliding path.

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